

## **REMARKS**

Further and favorable reconsideration is respectfully requested in view of the foregoing amendments and following remarks.

### **Claim Amendments**

Claim 1 has been amended to recite that an aluminum concentration of the generated polymethylaluminoxane composition is in a range of from 9.1 wt.% to 9.4 wt.%. Support for this amendment is found in the Examples and Comparative Examples of Applicants' specification. Specifically, please see page 29, line 25 to page 30, line 1; page 31, lines 6-7; page 35, lines 4-5; and page 38, lines 11-12.

Additionally, the claims have been amended to replace "preparation" with "composition", and to delete the parentheses. These amendments are deemed editorial in nature, and do not affect the scope of the claims.

No new matter has been added to the application by these amendments.

### **Rejection of Claims Under 35 U.S.C. § 112, Second Paragraph**

The rejection of claims 1-3 as being indefinite under 35 U.S.C. § 112, second paragraph is respectfully traversed.

Initially, the rejections set forth in items (i) and (ii) have been rendered moot by the amendments to the claims, discussed above.

Regarding item (iii), the Examiner states that without specifying the relative amounts of polymethylaluminoxane, trimethylaluminum and toluene, the viscosity of the polymethylaluminoxane composition is not meaningful.

Applicants provide the following comments in this regard.

In the present MAO synthetic reaction, the molecular weight of the single molecule of MAO\*<sup>1</sup> may be varied depending on the ratio of Al/O. Furthermore, it is conceivable that the solution viscosity may be affected by the varied molecular weight of MAO. However, the important issue in this matter would be that the solution viscosity cannot uniquely be determined according to

the Al/O ratio and the composition of the MAO solution. This is because MAO molecules can form various types of associated structures due to complex interaction between them. A person of ordinary skill in the art would understand this phenomenon.

\*1: single molecule of MAO

Linear-chain structure:  $\text{Me}_2\text{Al}-(\text{O}-\text{AlMe})_n-\text{OAlMe}_2$

Ring structure:  $\text{MeAl}-(\text{O}-\text{AlMe})_n-\text{OAlMe}$

On the other hand, as the Examiner has pointed out, it is true that an increased amount of toluene serving as a solvent can decrease the solution viscosity in proportion.

Claim 1 recites a definition for the amount of trimethyl aluminum contained in the MAO preparation. In view of this and based upon the description in the Examples of the specification, Applicants have amended claim 1 to recite "(iv) an aluminum concentration of the generated polymethylaluminoxane composition is in a range of from 9.1 wt% to 9.4 wt%".

Applicants assert that the basis for the above rejection is now untenable and should be withdrawn.

#### **Patentability Arguments**

The patentability of the present invention over the disclosure of the reference relied upon by the Examiner in rejecting the claims will be apparent upon consideration of the following remarks.

#### **Rejection Under 35 U.S.C. § 103(a)**

The rejection of claims 1-3 under 35 U.S.C. § 103(a) as being unpatentable over Smith et al. (U.S. 5,831,109) is respectfully traversed.

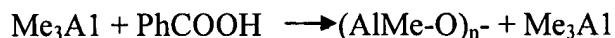
#### **The Position of the Examiner**

The Examiner takes the position that Smith et al. demonstrate the preparation of the

polymethylaluminoxane (PMAO) composition free of trimethylaluminum (TMAL) by reacting TMAL and benzoic acid in toluene with catalytic amount of polyaluminoxane (PMAO). The Examiner admits that Smith et al. do not expressly disclose the viscosity of the PMAO prepared from the Examples. However, the Examiner asserts that in the PMAO preparation process of Smith et al., the reaction between TMAL and benzoic acid is quantitative, and therefore the molecular weight of PMAO, which determines the viscosity, can be controlled by varying the ratio of TMAL to benzoic acid. The Examiner states that various viscosities would be obvious absent a showing of criticality and unexpected results.

#### Applicants' Arguments

The MAO synthesis reaction employing benzoic acid as an oxygen source can be represented by the following reaction formula:



In this case, it is conceivable that the molecular weight of MAO can be varied depending on the ratio of Al/O, and that the varied MAO molecular weight can affect the solution viscosity. However, the important issue in this matter would be that the solution viscosity cannot be uniquely determined according to the Al/O ratio and the composition of the MAO solution.

A person skilled in the art would fully understand that the MAO structure and the existing state of MAO in a solution have not been clarified. Accordingly, although many persons skilled in the art have proposed various measures for improving the MAO stability, the best solution presently is to store it in a cold place.

When comparing MAO solution of high concentration with that of low concentration, a person skilled in the art would know from experience that the low concentration solution can generally be stored for a longer period of time. However, such a person skilled in the art would not understand what factor controls the stability of the solution, and there has been no information about this in any publication. In an ideal situation, if a person skilled in the art was aware of the relationship between the solution viscosity and the stability, the results described in the present application might be expected. However, this critical relationship between the solution viscosity and the stability of the solution has not been known to those skilled in the art.

Smith et al. disclose that a compound having Al-O-C unit is generated by the reaction of trimethylaluminum with benzoic acid or carbon dioxide, and the thermo-decomposition of the compound can produce MAO. Furthermore, Smith et al. also disclose that the resulted MAO exhibits higher stability than a normal MAO prepared by hydrolysis. However, as admitted by the Examiner, Smith et al. do not teach the particular viscosity, as recited in Applicants' claims, not do Smith et al. discuss the critical relationship between the viscosity and the stability of the composition.

As stated on pages 6 and 7 of Applicants' specification, it is an object of the present invention to provide a polymethylaluminoxane composition which exhibits excellent storage stability. As discussed in the Examples, compositions according to Applicants' invention possessed excellent storage stability. Particularly, please see Examples 1-4, which each possess a viscosity of less than  $2.1 \times 10^{-3}$  Pa•sec. Each of these Examples was subjected to a storage stability test at 25°C for 90 days, and formation of gels and increase in viscosity were not observed. Example 5, which has a viscosity of  $2.02 \times 10^{-3}$  Pa•sec was subjected to the same test and formation of gels and increase in viscosity were not observed for 80 days, but deposition of gels was observed after 80 days. On the contrary, Comparative Examples 1-3, which each have viscosities outside Applicants' recited range, showed poor storage stability compared to the Examples discussed above.

Applicants researched the relationship between the change in the viscosity of the produced MAO solution and its stability, and found that a MAO which satisfies a certain condition is stable under a certain critical phenomenon existing in this system. Accordingly, Applicants invented the subject matter set forth in the claims.

For the reasons set forth above, Applicants have presented a showing of criticality and unexpected results based upon the viscosity of the composition.

For these reasons, the subject matter of claims 1-3 is clearly patentable over the cited reference.

### **Conclusion**

Therefore, in view of the foregoing amendments and remarks, it is submitted that each of the grounds of rejection set forth by the Examiner has been overcome, and that the application is in condition for allowance. Such allowance is solicited.

If, after reviewing this Amendment, the Examiner feels there are any issues remaining which must be resolved before the application can be passed to issue, the Examiner is respectfully requested to contact the undersigned by telephone in order to resolve such issues.

Respectfully submitted,

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June 6, 2008